NEW CANADIAN AIR DECOMPRESSION TABLES

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Ron Nishi
Defence and Civil Institute of Environmental Medicine

The Defence and Civil Institute of Environmental Medicine (DCIEM) has recently developed a new set of decompression tables for compressed air diving for use by the Canadian Forces. Based on over 20 years of decompression research at DCIEM, these tables provide a more conservative approach to decompression procedures than those published by the United States Navy and the Royal Navy. Selected profiles were tested extensively using the Doppler ultrasonic bubble detector as an aid to assessing the severity of the decompression stress produced by these tables. These tables were tested in a hyperbaric chamber with wet-working divers in cold water at 10° Celsius as well as with dry-resting divers. No realistic decompression procedures can totally eliminate the occurrence of decompression sickness. However, these tables are believed to be safer than most existing tables.

The tables, as developed by DCIEM, include Standard Air, In-Water Oxygen Decompression, and Surface Decompression with Oxygen. In addition, tables for Repetitive Diving and Corrections for Altitude have been developed. Of interest to the recreational diver are three tables:

Table A. Short Air Decompression.

Table B. Repetitive Dive Factors.

Table C. Allowable No-Decompression Limits for Repetitive Dives.

It is intended that the three tables will be produced on a plastic card complete with instructions for their use. These tables have been adopted by ACUC INTERNATIONAL for diver training.

The Short Standard Air Decompression Table (Table A) is a simplified version of the complete Standard Air Table. It consists of two sections - a **no-decompression** section on the left of the double vertical lines and a **decompression-required** section to the right of the lines. Each entry in the table gives a bottom time and a **Repetitive Dive Group**. (*Note that these repetitive groups are different from and thus incompatible with the repetitive dive groups of the US Navy tables.*) When bottom times appear without a repetitive group, repetitive diving is not recommended.

In the no-decompression region, several bottom times are given for each depth. These are for the purposes of calculating repetitive dives. The no-decompression limits in Table A are operational limits and it is not necessary to reduce these for recreational use. In addition, the no-decompression limits in Table A are for first dives only. For repetitive no-decompression dives, more conservative limits are required. These are given in Table C.

For bottom times in the "decompression-required" section of Table A, the decompression stop times and stop depths are specified at the bottom of the table. However, recreational divers are urged to remain within the no-decompression limits whenever possible.

A dive is considered a repetitive dive if it is performed less than 9 to 18 hours (depending on the repetitive dive group) after surfacing from a previous dive. In Table B, for each repetitive dive group, repetitive dive factors are given for surface intervals to 18 hours. The planned bottom time of the repetitive dive is multiplied by these dive factors to obtain the **Effective Bottom Time (EBT)**. This EBT is the combined total of the actual bottom time and the time that must be considered to have been already spent at that depth because of the residual nitrogen remaining in the body from the previous dive.

In Table C, the allowable no-decompression limits for second and subsequent dives are shown for each depth as a function of the repetitive dive factor. Thus, with this table, calculations are unnecessary for no-decompression repetitive dives. For any repetitive dive, this table should be consulted to determine whether the planned dive can be done as a no-decompression dive or whether decompression will be required. The repetitive dive group at each depth for all repetitive factors is given at the right of the table.

The general rules for the use of the three tables are:

Descent rate is 60 feet seawater/minute (fsw/min).

Ascent rate and **travel rate** between stops is 60 ± 10 fsw/min.

Bottom time is time from leaving the surface to leaving bottom.

Stop time includes ascent time to the stop.

Surface interval is the time in hours and/or minutes between surfacing from one dive and descending on the next.

Example 1: Dive to 130 fsw for 13 min.

Table A calls for a 10 min stop at 10 fsw. Ascent time to 10 fsw stop at 60 fsw/min is 2 min. Therefore, "actual" stop time at 10 fsw is 8 min.

INSTRUCTIONS FOR REPETITIVE DIVING

1. Find the **First dive Repetitive Dive Group (RG)** from Table A.
2. Find the **Repetitive Dive Factor (RF)** from Table B under the appropriate **Surface Interval (SI)**.
3. **FOR NO-DECOMPRESSION REPETITIVE DIVES.**
   (a) From Table C, find the **Allowable No-decompression Limit**, under the RF for the maximum depth of the second dive. The new RG for each of the times given in Table C is indicated in column on the right side.
   (b) If another dive is planned and if the actual bottom time of the second dive is less than the allowable limit, multiply the actual bottom time by the RF to obtain the **Effective Bottom Time (EBT)**. Find the new RG from the EBT and depth in Table A.
   Example 2: First Dive - 60 fsw for 30 min. RG = 'D' (Table A).
   SI before next dive = 1 hr. RF = 1.4 from Table B.
   Second Dive Depth is 50 fsw. Maximum allowable bottom time is 45 min. RG = 'G' (Table C).
   The actual bottom time planned is only 30 min and a third dive is intended later. Therefore, the EBT = 30 x 1.4 (RF for first dive) = 42 min, with an RG of 'E'.
   SI before third dive is 1 hr 15 min. RF = 1.5.
   Third Dive Depth is 40 fsw. From Table C, the maximum allowable bottom time at 40 fsw is 115 min.

Example 3. Finding the **minimum SI for a no-decompression dive**.
First Dive is 80 fsw for 25 min. RG = 'E' (Table A).
Second Dive depth is 60 fsw; the planned bottom time is 30 min.
From Table C, 30 min bottom time at 60 fsw is allowed by RF = 1.3. From Table B, for a first dive of RG 'E', a SI of 2 hr is required for the RF to decrease to 1.3.
(If another dive is planned, the EBT for the second dive is 30 x 1.3 = 39 min and the RG is 'F'.)

4. **FOR REPETITIVE DIVES REQUIRING DECOMPRESSION.**
   (a) Multiply the actual bottom time of the second dive by the RF to obtain the EBT. Decompress for the depth and EBT.
   Example 4: First Dive is 120 fsw for 15 min; (RG = 'D').
   SI = 40 min; RF = 1.5.
   Second Dive is 120 fsw for 10 min; EBT = 10 x 1.5 = 15 min. Decompress for 120 fsw for 15 min; EBT (RG = 'D').
   SI before third dive = 65 min; RF = 1.4.
   Third Dive is 80 fsw for 20 min; EBT = 20 x 1.4 = 28 min.
   Decompress for 80 fsw for 28 min EBT (RG = 'F').

(b) For bottom times exceeding the allowable no-decompression limits in Table C, but with EBT's less than the no-decompression limit in Table A, a 5 min decompression stop at 10 fsw is mandatory.

Example 5. First Dive is 60 fsw for 50 min; RG = 'F'.
SI to next dive = 1 hr 45 min.
Second Dive planned is 60 fsw for 30 min; RF is 1.5.
EBT is 1.5 x 30 = 45 min which is in the No-D range of Table A. However, from Table C, only 26 min is allowed for RF = 1.5. Therefore, the decompression required is 5 min at 10 fsw.

5. FOR SURFACE INTERVALS LESS THAN 30 MINUTES.

(a) **If the first and second dives are in the same depth range**, add the bottom times of the first and second dives to obtain the EBT for the second dive.

Example 6: First dive is 60 fsw for 30 min. SI is 15 min.
Second dive is 60 fsw for 25 min. EBT is 30 + 25 = 55 min. Decompression required is 5 min at 10 fsw (RG = 'G').

(b) **If the depths of the first and second dives are different**, take the RG of the first dive, find the bottom time of the corresponding or higher RG at the second dive depth. Add the intended bottom time of the second dive to this value to calculate the EBT for the second dive.

Example 7: First dive is 120 fsw for 10 min. RG = 'C'.
SI is 15 min; Second dive planned is 70 fsw for 15 min.
Group 'C' dive at 70 fsw has an equivalent bottom time of 25 min (bottom time for 'D' dive selected since there is no 'C' dive). Therefore, the EBT for second dive is 25 + 15 = 40 min.
Decompression required is 5 min at 10 fsw.

OMITTED DECOMPRESSION - Diver with NO SYMPTOMS

a. Recompression chamber (RCC) immediately available (less than 7 min). Recompress diver in RCC on O_2 to 40 fsw. Remain on O_2 at 40 fsw for **twice** the omitted decompression time. Ascent on O_2 is 2 min.

b. RCC not immediately available. Return diver (within 7 min) to next **deeper** stop in the water where omission occurred and repeat this stop. Continue decompression in accordance with schedule; **OR** if no deeper stop was required, spend the time of the first stop at the next deeper stop and repeat total schedule.

Example 8: Dive - 140 fsw for 14 min
Decompression required is 5 min at 20 fsw, 10 min at 10 fsw.
Situation - On ascent to 20 fsw, diver "blows up"; diver has no symptoms.
Reaction - Diver to 30 fsw for 5 min, 20 fsw for 5 min, 10 fsw for 10 min.

INSTRUCTIONS FOR DIVING AT ALTITUDE

These tables are for use from sea level to 999 ft altitude. For diving at higher altitudes, refer to the DCIEM "Depth Corrections for Diving at Altitude Table".

RECOMMENDATIONS FOR FLYING AFTER DIVING

For Recreational Diving
12 hours after No-Decompression dives.
24 hours after dives requiring decompression.

USE THE FOLLOWING EXERCISES TO TEST YOUR KNOWLEDGE OF THE NEW CANADIAN DIVE TABLES:

1. **TABLE A**
Determine the **Repetitive Dive Group (RG)** for each of the following dives:

a. 110 fsw for 12 minutes _____
b. 59 fsw for 50 minutes _____
c. 40 fsw for 30 minutes _____
d. 27 fsw for 82 minutes _____

2. **TABLE B**
Find **Repetitive Dive Factor (RF)** after each of the following **Surface Intervals (SI)**:

a. Group A after SI of 1:00 ___.___
b. Group B after SI of 3:00 ___.___
c. Group C after SI of 1:00 ___.___
d. Group D after SI of 1:30 ___.___
e. Group E after SI of 1:34 ___.___
f. Group F after SI of 1:45 ___.___
g. Group G after SI of 1:56 ___.___

3. **TABLE C**
Determine the **Allowable No-Decompression Limit** and corresponding RG for each of the following repetitive dives:

a. 110 fsw with RF of 1.3 _____ min → RG _____
b. 59 fsw with RF of 1.2 _____ min → RG _____
c. 125 fsw with RF of 1.6 _____ min → RG _____
d. 85 fsw with RF of 1.1 _____ min → RG _____

4. Use the dive tables to complete the following **no-decompression** repetitive dive:
1st dive to 70 fsw for 35 minutes; Surface Interval (SI) of 2:00; 2nd dive to 57 fsw.

a. What is the RG after the 1st dive? (Table A) RG _____
b. What is the RF after the SI? (Table B) RF ___.___
c. What is the Allowable No-Decompression Limit for 2nd dive? (Table C) _____ min
d. If the **actual bottom time** on the 2nd dive was 20 min, what would the RG be?
(Table A) 20 min x ___.___(RF) = _____(EBT) min at 57 fsw → RG _____

5. Use the dive tables to complete the following **decompression** dives:

i. 1st dive to 120 fsw for 15 min; SI of 1:30; 2nd dive to 79 fsw for 30 minutes
ii. 1st dive to 79 fsw for 29 min; SI of 1:50; 2nd dive to 57 fsw for 40 minutes

a. What is the decompression stop requirement and RG after each of 1st dives?
i. _____ min at _____fsw RG_____
ii. _____ min at _____fsw RG_____

b. What is the RF after each SI? (Table B)
i. ___.___ (RF) ii. ___.___ (RF)

c. What is the **Effective Bottom Time (EBT)** for each of the repetitive dives?
i. _____ (EBT) min at 79 fsw ii. _____ (EBT) min at 57 fsw

d. What is the decompression stop requirement and RG after each of the repetitive dives? (Table A)
i. _____ min at _____ fsw stop; _____ min at _____ fsw stop; RG _____
ii. _____ min at _____ fsw stop; RG _____

6. **Determine the Minimum Surface Interval** necessary to stay within the no-decompression limits for the following dives:

   a. **1st dive to 70 fsw for 30 minutes**
      2nd dive to 50 fsw for 50 minutes minimum Surface Interval _____:_____

   b. **1st dive to 60 fsw for 50 minutes**
      2nd dive to 60 fsw for 30 minutes minimum Surface Interval _____:_____

ANSWER KEY:

1. a. C b. F c. B d. D
2. a. 1.1 b. 1.1 c. 1.3 d. 1.3 e. 1.4 f. 1.5 g. 1.6
3. a. 8 min → C b. 35 min → F c. 5min → B d. 16 min → D
4. a. E b. 1.3 c. 30 min d. 26 min (EBT) at 57 fsw → D
5. a. i. 10 min at 10 fsw → D ii. 5 min at 10 fsw → F
   b. i. 1.3 ii. 1.5
   c. i. 39 min (EBT) at 79 fsw ii. 60 min (EBT) at 57 fsw
   d. i. 5 min at 20 fsw; 10 min at 10 fsw → H ii. 5 min at 10 fsw → G
6. a. 2:00 SI b. 3:00 SI

SHORT AIR DECOMPRESSION

Depth (fsw)	No-Decompression Bottom Times (min)			Decompression Required Bottom Times (min)			
30	30 A 60 C	90 D 120 F	180 H 380				
40	30 B 60 D	90 G 120 H	150 J 175 L	185	190	199	206
50	30 C	50 E	75 G	95 I	115 K	122 K	127 L
60	20 B	30 D	50 F	60 G	80 I	84 J	88 J
70	15 B	25 D	35 E	40 F	50 G	63 I	66 J
80	10 A	20 D	25 E	29 F	35 G	48 H	52 I
90	10 A	15 C	20 D	23 E	27 F	36 H	43 I
100	5 A	10 B	15 D	18 D	21 E	29 G	33 H
110	5 A	10 B	12 C	15 D	18 D	23 F	30 H
120		5 A	10 C	12 D	15 D	19 F	25 G
130		5 A	8 B	10 C	13 D	16 F	21 G
140		5 A	7 B	9 C	11 D	14 F	18 G
150			6 B	8 C	10 D	12 E	15 F
Decompression Time (minutes)			20 fsw	-	-	5	10
			10 fsw	5	10	10	10

TABLE A

REPETITIVE DIVE FACTORS

Repetitive Dive Group	Surface Intervals (hr:min)								
	0:30 →0:59	1:00 →1:29	1:30 →1:59	2:00 →2:59	3:00 →3:59	4:00 →5:59	6:00 →8:59	9:00 →11:59	12:00 →18:00
A	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0
B	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0
C	1.4	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.0
D	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0
E	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1
F	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1
G	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
H	-	1.9	1.7	1.6	1.5	1.4	1.3	1.1	1.1
I	-	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.1
J	-	-	1.9	1.8	1.6	1.5	1.3	1.2	1.1
K	-	-	2.0	1.9	1.7	1.5	1.3	1.2	1.1
L	-	-	-	2.0	1.7	1.6	1.4	1.2	1.1

TABLE B

ALLOWABLE NO-DECOMPRESSION LIMITS FOR REPETITIVE DIVES

Depth (fsw)	Allowable No-D Limit (minutes) for Repetitive Factors										Rep. Gr.
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	
40	160	145	135	125	115	105	96	90	85	80	L
50	60	55	50	45	41	38	35	33	31	30	G
60	40	35	30	28	26	24	23	22	21	20	F
70	30	25	21	19	18	17	16	15	14	13	E
80	20	17	15	14	13	12	11	11	10	10	E
90	16	14	12	11	10	10	9	8	8	8	D
100	13	11	10	9	9	8	7	7	6	6	D
110	10	9	8	7	7	6	6	6	5	5	C
120	8	7	6	6	6	5	5	5	4	4	C
130	7	6	6	5	5	5	4	4	4	4	B
140	6	5	5	5	4	4	4	3	3	3	B
150	5	5	4	4	4	3	3	3	3	3	B

TABLE C